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THE GERM THEORY IN DISEASE AND FERMENTATION.

Extracts from a paper read before the

Hamilton Association

BY

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THE GERM THEORY

—IN—

DISEASE AND FERMENTATION.

NOTE.—The following is only part of Prof. Wright's paper.

It may be suggested that it will be no agreeable journey to go investigating malarious disorders among refuse heaps, noisome cellars and crowded alleys; that it will shock our nerves to yet too familiar with these of fensive and hideous abortions of nature. As the humorist, Barham, in the *Ingoldsby Legends*, pictures the naturalist,

"Who would pore by the hour,
O'er a weed or a flower,
Or the slug, that come crawling out after a shower;
Still poking his nose into this thing or that,
At a gnat, or a bat, or a rat, or a cat,
Or great ugly things,
All legs and wings,
With nasty long tails, armed with nasty long stings."

Let us bethink ourselves, however, that these researches may save many lives, and that we cannot individually foresee how exceedingly valuable to us in some crisis of our life history may be our knowledge. Furnished with the recent investigations of scientists, physicians are combatting the diseases of humanity with new weapons, and with at least fair promise of effecting in due time the repression of the epidemic disorders, which periodically decimate the populations of the globe. As the real cause is unmasked, the practitioner will be able both to prevent and to cure on a scientific as well as experimental basis. We find Professor Lister and his followers buried with the "antiseptic system" of treatment, which takes as its keynote and standpoint the fact that the germs of lower life floating in the air are the prime cause of much suffering and frequent death after surgical operations and hence they keep a spray of carbolic acid playing upon the wound, and they can now undertake cases which would have been perilous before.

PROOF OF GERM ORIGIN

A well established principle in reference to infectious diseases, is that their poisons can reproduce themselves, and to an unlimited extent by using comparatively minute quantities—as a good example, the vaccine virus. How similar this is to fermentation and putrefaction every one is aware. A second characteristic, which they all exhibit, is their thorough adherence to uniformity, viz., under all circumstances a given kind of disease is solely due to a given kind of morbid agent or cause. In the other class of diseases, such as colds, they are not thus uniform in effects at different times and on different individuals. In measles and small pox there are degrees of severity, but the kind does not vary. Outward circumstances, seasons and climates, do not affect any transmutation into any other diseases.

CONCOMITANT NOT THE CAUSE.

A concomitant or helper of a disease should not be confounded with the cause of it. It was once thought the plague came from the imperfect burial of human corpses; but the battlefields of Inkerman, strewn with corpses, whose stench drove the armies away, produced no pestilence.

ONE ATTACK A PREVENTIVE.

A third peculiarity of these types is, that a single attack of the disease successfully surmounted bestows immunity from it for a part or for the whole of life. Here the analogy of fermentation aids us. If yeast be placed in a saccharine solution, fermentation takes place, and when complete, cannot be revived by more yeast. In the course of development of a contagious disease, there is a destruction or change of certain constituents of the body,

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which being once used up cannot form its food again.

NO OTHER CAUSE ADEQUATE.

A fourth proof may be derived from the difficulty of finding any other cause that would explain the phenomena. Poisons like belladonna would be just as destructive, but they would be entirely destitute of the property of contagiousness. No stretch of the imagination would make us believe that belladonna could be floating in the air.

INCUBATION.

There are three periods in most of these diseases: incubation, from reception of the poison to first symptoms; growing state, from first symptoms to its full manifestations; lastly, the stages of its final course; all these changes doubtless having something to do with the phases of evolution of the morbid agent. For example, the length of incubation is the same, whether a man use much or little virus, whether he introduce it at one or ten points. The exactness of the period then does not result from the simple multiplying of the organisms, but from the time they need to mature.

MIASMATIC AND CONTAGIOUS DISEASES.

As to the use of the terms miasmatic and contagious, the former refers to agents originating in the outside world; the latter, when they come from the diseased patient. A third class includes those which come only indirectly from affected parties. Intermittent malarial diseases go with the first, measles, scarlet fever, small pox, typhus fever, diphtheria, etc., are directly contagious. Cholera, typhoid fever, dysentery and probably yellow fever are indirect. Nearness in case of cholera and typhoid fever has been proved in many cases to be innocuous. But if the organisms passing from these patients secure a second development by long standing or by mixing with decomposing organic substances in refuse heaps, sewers, etc., then the poison is rapidly diffusible.

CHOOSE THEIR ZONE AS PLANTS DO.

As plants and animals have their natural centres, so many of these diseases have their special homes; India of cholera; the Gulf of Mexico of the yellow fever; the delta of the Nile of the plague; the prairies of the ague. The freaks of development in natural history show a striking analogy to the breaking out of epidemics. We may find a usually inoffensive insect give rise on a sudden to great destruction, or a commonly harmless fungus destroy all at once a crop of roots or a harvest of seed. The reason is, that at long intervals they find the circumstances of luxurious development occurring, and then wide spread calamity results. The grasshopper plague of the Rocky Mountains is only occasional. A similar pest is found in Switzerland, and

some centuries ago more severely than at present for in the chief town of Valsais a grasshopper mass was solemnly held each year on the 1st of May.

LOCALIZE IN THE HUMAN SYSTEM.

As plants always choose their location, whether wet, dry, shady, or lofty, so the various fungi show their highest development, each in its favorite locality, as the surface in measles, scarlet fever, and smallpox; the throat in diphtheria, the respiratory mucous membrane in whooping cough, and the digestive tract in typhoid fever and cholera.

FEVER AND AGUE.

The causes of fever and ague are so familiar that all will readily acknowledge vegetable decomposition as the efficient agent. Salisbury, an American author, found that the saliva of the sick contained small, elongated cells, presenting themselves singly or in rows, which he considered alga cells of the species palmella. These he also found and collected on glass plates, set up over marshy ground, and in great quantities on the clods of an upturned marshy soil. They never occurred higher than 100 feet above sea level. He was able to produce the most intense attacks of intermittent fever by means of the fresh clods, if allowed to place them within the open window of a sleeping room in a house lying about 300 feet above sea level. His views seem reasonable, but to become established need the corroborative investigations of others. Binz, of Germany, has shown that quinine is destructive of all fungus growths. The scientist looks forward with confidence to the time when an equally efficient agent will be found for the contagious diseases and the destruction of the germ in every zymotic disease. Passing to the class of contagious diseases, the evidence is accumulating that they are due to those lowest of vegetable forms of extreme minuteness and only propagating by budding, called bacteria. No authors have classified the disease germs, as completely as Pasteur did the fermentoid organisms, though Ferdinand Cohn of Breslau, a leader in microscopy in Germany, has done much, but cannot yet fully determine the special bacterium productive of every infectious disease.

THREE KINDS OF BACTERIA.

He makes a convenient classification of the bacteria by their shape into the globular, the rod-like, and the spiral. The globular ones he found in diphtheria and small-pox; the rod-like in scarlet fever and malignant pustule; and the spiral in relapsing fever. In cholera the globular form is abundantly found, but mingled so plentifully with other organisms that certainty has not yet been attained.

TYPHUS FEVER.

The proof of a fungous germ in typhus

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fever and yellow fever is as strong as in the other zymotics, but the species of bacterium has not been identified. The tenacity of the poison in typhus fever, in consequence of which even articles of dress may serve to transport and extend the disease is a characteristic only to be explained by the presence of a subtle agent capable of living even in a thoroughly dried state, and there is no other than the germ idea which in any degree satisfies the conditions.

TYPHOID FEVER.

It is evident that typhoid fever does not result from the simple decomposition of either animal or vegetable substances. The list of diseases arising from the same cause would be so long as to render the theory unanswerable; there would be too many results from the same agent. It follows that the decomposing substances must be mixed with the germs of the specific poison in each case. The simple appropriation of putrid substances may cause a diseased condition, but has never been the cause of typhoid fever as such. There are multitudes of unhealthy localities, where the inhabitants constantly inhale impure air, and yet there is no disease of this type. The most uncleanly cities are sometimes exempt, and the purest attacked, and yet if a single case occurs in these poorly kept localities it would sweep through them with the greatest virulence. We need not dwell upon the fungoid origin of this fever and diphtheria, for the experience of every physician and the columns of almost every newspaper furnish examples of the direct tracing of the affection to the predisposing cause in defective sewerage or neglected refuse.

PRINCE OF WALES.

The mansions of the great are not exempt from the penalty inflicted upon the breaking of Nature's laws. The sickness of the Prince of Wales, which caused so profound a sensation at the time, was attributed by some to defective sanitary arrangements in Carisbrook Castle, where he visited, and by others to the condition of Marlborough House itself, in London. One thing is undoubtedly true, that an amount of £4,000 was expended in remodeling the cellars and sewerage of the palace.

CITIES WITH WATERWORKS.

A source of congratulation to the city of Hamilton is, that communities which are not dependent upon wells for their supply of water, have been proved to be comparatively free from epidemic disease. In London the cholera of 1866 was very severe only in the east end, which was at that time supplied by the East London water company from Oldford. The reservoir was on the river Lee, which is little better than an open sewer receptacle. The consequence was that the mortality was eleven times greater than in the west end.

DIPHTHERIA.

In the special case of diphtheria the question arises, does the germ remain fixed upon the mucous membrane, with which it first comes in contact, or is there a general effect upon the body and then the local result? This question is a pertinent one, for in the disease of glanders an instance has occurred in which a horse was inoculated with the nasal mucus by hypodermic injection, and still the symptoms came out as usual in the nose. Oertel, who has investigated diphtheria, has satisfied himself that it begins at the spot first reached by the germ, and afterwards proceeds to the whole system. In the very beginning of the disease these organisms are already present in delicate, ring-shaped, grayish white spots in the throat. These spots consist solely of epithelial layers, which have been penetrated and pushed out by bacterial growths. In numerous cases he produced direct inoculation of rabbits by an application of diphtheritic matter in the throat. The globular bacteria have been found by him in great abundance in the false membrane formed, the blood and the tissues; and in this case as many as a dozen other microscopists confirm his views. The mass of bacteria in the body forms an exact criterion of the severity of the disease.

SMALL POX.

Ferdinand Cohn found in the fresh lymph taken from vaccine and small pox pustules the globular bacteria, and when he watched them for some time they became segmented and formed small chains and masses. He considers these organisms to be probably the vehicles of contagion, certainly not mere chance products. Zulzer lays particular stress upon the presence of these bodies in the walls of the blood vessels, and thinks they are the active causes of the spots in the purple varioloid. Lebert believes that the dangerous effect on animals of the bite of the Tsetse fly in Africa, so often mentioned by Livingstone, is due to a real inoculation by the insect after having just preyed upon carrion.

SCARLET FEVER.

Messrs. Coze and Feltz inoculated 66 rabbits with a small quantity of scarlet fever blood; 62 died, and an examination of their blood revealed an unnatural condition of the corpuscles, and also numbers of rod like bacteria. Riess examined the blood drawn from the arm of a patient and found abundance of the same. Here also there is corroborative testimony. The volatility of the contagion of scarlet fever is less than that of measles, and hence not so rapid a diffusion, but it clings more tenaciously than the other to clothing.

